



THE UNITED STATES OF AMERICA

TO ALL TO WHOM THESE PRESENTS SHALL COME:

Pioneer Hi-Bred International, Inc.

Whereas, THERE HAS BEEN PRESENTED TO THE

Secretary of Agriculture

AN APPLICATION REQUESTING A CERTIFICATE OF PROTECTION FOR AN ALLEGED NOVEL VARIETY OF SEXUALLY REPRODUCED PLANT, THE NAME AND DESCRIPTION OF WHICH ARE CONTAINED IN THE APPLICATION AND EXHIBITS, A COPY OF WHICH IS HEREUNTO ANNEXED AND MADE A PART HEREOF, AND THE VARIOUS REQUIREMENTS OF LAW IN SUCH CASES MADE AND PROVIDED HAVE BEEN COMPLIED WITH, AND THE TITLE THERETO IS, FROM THE RECORDS OF THE PLANT VARIETY PROTECTION OFFICE, IN THE APPLICANT(S) INDICATED IN THE SAID COPY, AND WHEREAS, UPON DUE EXAMINATION MADE, THE SAID APPLICANT(S) IS (ARE) ADJUDGED TO BE ENTITLED TO A CERTIFICATE OF PLANT VARIETY PROTECTION UNDER THE LAW.

NOW, THEREFORE, THIS CERTIFICATE OF PLANT VARIETY PROTECTION IS TO GRANT UNTO THE SAID APPLICANT(S) AND THE SUCCESSORS, HEIRS OR ASSIGNS OF THE SAID APPLICANT(S) FOR THE TERM OF *eighteen* YEARS FROM THE DATE OF THIS GRANT, SUBJECT TO THE PAYMENT OF THE REQUIRED FEES AND PERIODIC REPLENISHMENT OF VIABLE BASIC SEED OF THE VARIETY IN A PUBLIC REPOSITORY AS PROVIDED BY LAW, THE RIGHT TO EXCLUDE OTHERS FROM SELLING THE VARIETY, OR OFFERING IT FOR SALE, OR REPRODUCING IT, OR IMPORTING IT, OR EXPORTING IT, OR USING IT IN PRODUCING A HYBRID OR DIFFERENT VARIETY THEREFROM, TO THE EXTENT PROVIDED BY THE PLANT VARIETY PROTECTION ACT (U.S.C. 1542, AS AMENDED, 7 U.S.C. 2321 ET SEQ.)

ALFALFA

'5151'

In Testimony Whereof, I have hereunto set my hand and caused the seal of the Plant Variety Protection Office to be affixed at the City of Washington, D.C. this 30th day of April in the year of our Lord one thousand nine hundred and ninety-three.

Attest:

Kenneth H. Evans
Commissioner
Plant Variety Protection Office
Agricultural Marketing Service

Mike Egan
Secretary of Agriculture



U.S. DEPARTMENT OF AGRICULTURE
AGRICULTURAL MARKETING SERVICE

APPLICATION FOR PLANT VARIETY PROTECTION CERTIFICATE
(Instructions on reverse)

Application is required in order to determine if a plant variety protection certificate is to be issued (7 U.S.C. 2421). Information is held confidential until certificate is issued (7 U.S.C. 2426).

1. NAME OF APPLICANT(S) (as it is to appear on the Certificate) Pioneer Hi-Bred International, Inc.		2. TEMPORARY DESIGNATION OR EXPERIMENTAL NO. XAE05	3. VARIETY NAME 5151
4. ADDRESS (street and no. or R.F.D. no., city, state, and ZIP) 7305 N. W. 62nd Ave., P. O. Box 287 Johnston, IA 50131		5. PHONE (include area code) 515-270-3340	FOR OFFICIAL USE ONLY PVPO NUMBER 9200219
6. GENUS AND SPECIES NAME Medicago sativa	7. FAMILY NAME (Botanical) Leguminosae		FILING DATE June 22, 1992 Time 2:10 <input type="checkbox"/> A.M. <input checked="" type="checkbox"/> P.M.
8. CROP KIND NAME (Common Name) Alfalfa	9. DATE OF DETERMINATION August, 1988		FILING AND EXAMINATION FEE: \$ 2150.00 Date June 19, 1992
10. IF THE APPLICANT NAMED IS NOT A "PERSON," GIVE FORM OF ORGANIZATION (Corporation, partnership, association, etc.) Corporation			CERTIFICATE FEE: \$ 250.00 Date April 12, 1993
11. IF INCORPORATED, GIVE STATE OF INCORPORATION Iowa	12. DATE OF INCORPORATION 1926		

13. NAME AND ADDRESS OF APPLICANT REPRESENTATIVE(S), IF ANY, TO SERVE IN THIS APPLICATION AND RECEIVE ALL PAPERS
William T. W. Woodward, 7305 N. W. 62nd Ave., P. O. Box 287, Johnston, IA 50131
John Hintze, 700 Capital Square, 400 Locust Street, Des Moines, IA 50309
Mike Roth, 700 Capital Square, 400 Locust Street, Des Moines, IA 50309

PHONE (include area code):

14. CHECK APPROPRIATE BOX FOR EACH ATTACHMENT SUBMITTED (Follow INSTRUCTIONS on reverse)

a. ☒ Exhibit A, Origin and Breeding History of the Variety.
b. ☒ Exhibit B, Novelty Statement.
c. ☒ Exhibit C, Objective Description of Variety.
d. ☒ Exhibit D, Additional Description of Variety.
e. ☒ Exhibit E, Statement of the Basis of Applicant's Ownership.
f. ☒ Seed Sample (2,500 viable untreated seeds). Date Seed Sample mailed to Plant Variety Protection Office 6-8-92.
g. ☒ Filing and Examination Fee (\$2,150) made payable to "Treasurer of the United States."

15. DOES THE APPLICANT(S) SPECIFY THAT SEED OF THIS VARIETY BE SOLD BY VARIETY NAME ONLY AS A CLASS OF CERTIFIED SEED? (See section 83(b) of the Plant Variety Protection Act.)
☐ YES (If "YES," answer items 16 and 17 below) ☒ NO (If "NO," skip to item 18 below)

16. DOES THE APPLICANT(S) SPECIFY THAT THIS VARIETY BE LIMITED AS TO NUMBER OF GENERATIONS?
☐ YES ☐ NO

17. IF "YES" TO ITEM 16, WHICH CLASSES OF PRODUCTION BEYOND BREEDER SEED?
☐ FOUNDATION ☐ REGISTERED ☐ CERTIFIED

18. DID THE APPLICANT(S) PREVIOUSLY FILE FOR PROTECTION OF THE VARIETY IN THE U.S.?
☐ YES (If "YES," through ☐ Plant Variety Protection Act ☐ Patent Act. Give date: _____)
☒ NO

19. HAS THE VARIETY BEEN RELEASED, USED, OFFERED FOR SALE, OR MARKETED IN THE U.S. OR OTHER COUNTRIES?
☐ YES (If "YES," give names of countries and dates)
☒ NO

20. The applicant(s) declare(s) that a viable sample of basic seeds of this variety will be furnished with the application and will be replenished upon request in accordance with such regulations as may be applicable.
The undersigned applicant(s) is (are) the owner(s) of this sexually reproduced novel plant variety, and believe(s) that the variety is distinct, uniform, and stable as required in section 41, and is entitled to protection under the provisions of section 42 of the Plant Variety Protection Act.
Applicant(s) is (are) informed that false representation herein can jeopardize protection and result in penalties.

SIGNATURE OF APPLICANT (Owner(s)) PIONEER HI-BRED INTERNATIONAL, INC.	CAPACITY OR TITLE	DATE
SIGNATURE OF APPLICANT (Owner(s)) By William T. W. Woodward	Director, Department of Alfalfa Breeding	6-8-92 1

EXHIBIT A

ORIGIN AND BREEDING HISTORY OF THE VARIETY

'5151'

5151 is a synthetic variety comprised of 1,000 plants originating from experimental lines tracing to 'Vernal', N.S. 47 (14%), A224, A604, C-6, N.S. 31, ScMa 601, 'Culver' (2%), and other Pioneer germplasm (34%) which trace mainly to creeping rooted selections from Canada. Parent plants were randomly selected from 86GJH09 whose parents were selected through phenotypic recurrent selection from various experimental lines for one or more of the following: spreading growth habit, above average top growth, field appearance, and resistance to spotted alfalfa aphid and bacterial wilt. Germplasm sources are: M. falcata (40%), Ladak (5%), M. varia (13%), Turkistan (1%), Chilean (4%) and unknown (37%).

During seed multiplication no variates beyond the limits defined under Exhibit C have been found. Multiplication procedures will insure that seed being sold as 5151 will not be shifted in characteristics beyond presently acceptable limits for alfalfa varieties. Syn 2 seed harvested from parental plants in 1988 in field isolation is considered breeder seed.

It is confirmed that 5151 meets presently acceptable levels for uniformity for alfalfa varieties.

9200219

EXHIBIT B

NOVELTY STATEMENT

'5151'

5151 most closely resembles the variety 'Spreador 2'. 5151 differs from Spreador 2 in spotted alfalfa aphid resistance, being classified as having resistance, while Spreador 2 is susceptible to the insect.

U.S. DEPARTMENT OF AGRICULTURE
AGRICULTURAL MARKETING SERVICE
LIVESTOCK AND SEED DIVISION
PLANT VARIETY PROTECTION OFFICE
BELTSVILLE, MARYLAND 20705

EXHIBIT C
(Alfalfa)

OBJECTIVE DESCRIPTION OF VARIETY
ALFALFA (*Medicago sativa* sensu Gunn et al.)

NAME OF APPLICANT(S) Pioneer Hi-Bred International, Inc.	TEMPORARY DESIGNATION XAE05	VARIETY NAME 5151
ADDRESS (Street and No., or R.F.D. No., City, State, and Zip Code) 7305 N. W. 62nd Ave., P. O. Box 287 Johnston, IA 50131		FOR OFFICIAL USE ONLY PVPO NUMBER 9200219

PLEASE READ ALL INSTRUCTIONS CAREFULLY: Place numbers in the boxes to designate the expressions which are characteristic of the commercial generations of the application variety. Data for quantitative plant characters should be based on a minimum of 100 plants. Include leading zeros when necessary (e.g.,) for quantitative data. Comparative data should be determined from varieties entered in the same trial. Plant color may be precisely designated by using any recognized color chart, e.g., The Munsell Plant Tissue Color Charts.

1. WINTERHARDINESS:

 CLASS:

- | | |
|--|--------------------------------------|
| 1 = Very Non-Winterhardy (CUF 101) | 2 = Non-Winterhardy (Moapa 69) |
| 3 = Intermediately Non-Winterhardy (Mesilla) | 4 = Semi-Winterhardy (Lahontan) |
| 5 = (Du Puits) | 6 = Moderately Winterhardy (Saranac) |
| 7 = (Ranger) | 8 = Winterhardy (Vernal) |
| 9 = Extremely Winterhardy (Norseman) | |

TEST LOCATION: Arlington, WI; Johnston, IA

2. FALL DORMANCY:

FALL DORMANCY (DETERMINED FROM SPACED PLANTINGS)

TESTING INSTITUTION AND LOCATION	DATE OF LAST CUT	DATE REGROWTH SCORED	REGROWTH SCORE OR AVERAGE HEIGHT				LSD .05
			APPLICATION VARIETY	CHECK VARIETIES*			
				Norseman	Vernal	Arrow	
Pioneer Hi-Bred International, Inc. Arlington, WI and Johnston, IA	9/91 8/91	10/91 10/91	10.7	9.4	12.5	16.0	1.6

* CUF 101, Moapa 69, Mesilla, Lahontan, Du Puits, Saranac, Ranger, Vernal, or Norseman as appropriate.

Specify scoring system used: Average height in cm of space plants; combined analysis using two locations;

10 replications with approximately 25 plants/rep.

Fall Growth Habit (Determined from Fall Dormancy Trials)

- | | | |
|----------------------------|--------------------------|----------------------------|
| 1 = Erect (CUF 101) | 3 = Semierect (Mesilla) | 5 = Intermediate (Saranac) |
| 7 = Semidecumbent (Vernal) | 9 = Decumbent (Norseman) | |

3. RECOVERY AFTER FIRST SPRING CUT (In Southwest, first cut after March 21):

- | | | | |
|--------------------------|--------------------|---------------------------|-------------------|
| 1 = Very Fast (CUF 101) | 3 = Fast (Saranac) | 5 = Intermediate (Ranger) | 7 = Slow (Vernal) |
| 9 = Very Slow (Norseman) | | | |

TEST LOCATION: Johnston, IA; Owatonna, MN

4. AREAS OF ADAPTATION IN U.S. (Where tested and proven adapted):

 Primary Area of Adaptation Other Areas of Adaptation

- | | | | |
|--|-------------------------------|------------------|---------------|
| 1 = North Central | 2 = East Central | 3 = Southeast | 4 = Southwest |
| 5 = Moderately Winterhardy Intermountain | 6 = Winterhardy Intermountain | 7 = Great Plains | |
| 8 = Other (Specify) _____ | | | |



5. FLOWERING DATE (When 10% of plants possess open flowers at time of first spring cut):

 Days Earlier Than Same As Days Later Than

- | | | | | |
|-------------|-------------|-------------|------------|--------------|
| 1 = CUF 101 | 2 = Mesilla | 3 = Saranac | 4 = Vernal | 5 = Norseman |
|-------------|-------------|-------------|------------|--------------|

TEST LOCATION: _____

6. PLANT COLOR (Determined from healthy regrowth 3 weeks after first spring cut, controlling leafhoppers if necessary):

☐ 1 = Very Dark Green (524) 2 = Dark Green (Vernal) 3 = Light Green (Ranger)

9200219

COLOR CHART VALUE (Specify chart used): _____

APPLICATION VARIETY: _____

VERNAL: _____

TEST LOCATION: _____

7. CROWN TYPE (Determined from spaced plantings):

☒ 4 Noncreeping Types: 1 = Broad (Vernal) 2 = Intermediate (Saranac) 3 = Narrow (CUF 101)

Creeping Types: 4 = Creeping Rooted (Rangelander) 5 = Rhizomatous (Rhizoma)

8. FLOWER COLOR (Determine frequency of plants for each color class as defined by USDA Agricultural Handbook No. 424 (Barnes 1972), allowing all plants in plot to flower):

☐ ☐ ☐ % Purple and Violet (Subclasses 1.1 to 1.4) ☐ ☐ ☐ % Blue (Subclasses 2.3 and 2.4)

☐ ☐ ☐ % Variegated Other Than Blue (Subclasses 2.1, 2.2, 2.5 to 2.9) ☐ ☐ ☐ % Yellow (Subclasses 4.1 to 4.4)

☐ ☐ ☐ % Cream (Class 3) ☐ ☐ ☐ % White (Class 5)

TEST LOCATION: Johnston, IA; Connell, WA

9. POD SHAPE (Determine frequency of plants with the following pod shapes produced on well cross-pollinated racemes):

☐ ☐ ☐ % Tightly Coiled (One or more coils, center more or less closed) ☐ ☐ ☐ % Loosely Coiled (One or more coils, center conspicuously open)

☐ ☐ ☐ % Sickle (Less than 1 coil)

TEST LOCATION: _____

10. PEST RESISTANCE: Provide in the appropriate column, trial data for application variety, and resistant (R) and susceptible (S) check varieties, synthetic generation tested, average severity index scores (ASI), least significant difference statistics (LSD .05), the institution in charge of test, year, and location of test, and whether test is a field or laboratory evaluation. Describe scoring system, and any test procedure which differs from standard methods proposed by Elgin (1982). Trial data from other test years or locations should be presented whenever available on a separate document as Exhibit D. Seeds of the check varieties and germplasm lines listed below can be obtained from the USDA Field Crops Laboratory, Bldg. 001, Rm. 335, BARC-West, Beltsville, MD 20705. Although comparisons with check varieties listed below are preferred, comparisons with any appropriate check variety recommended by Elgin (1982) may be presented.

A. DISEASE RESISTANCE:	DISEASE	VARIETY	SYN. GEN. TESTED	PERCENT RESISTANT PLANTS	NUMBER OF PLANTS TESTED	ASI	ASI LSD .05	INSTITUTION, YEAR, LOCATION, FIELD OR LABORATORY
Anthracnose, Race 1 (<i>Colletotrichum trifolii</i>)	Application	S	2	0.0	~300		% Resistant Plants 18.4	Pioneer Hi-Bred International, Inc. 1989 Johnston, Ia Laboratory
	Arc (R)			65.0	"			
	Saranac (S)			0.0	"			
	SCORING SYSTEM: % surviving seedlings. Data adjusted to Arc at 65% resistant plants by Pioneer Hi-Bred International, Inc.							
Anthracnose, Race 2 (<i>Collectotrichum trifolii</i>)	Application							
	Saranac AR (R)							
	Arc (S)							
	SCORING SYSTEM:							
Bacterial Wilt (<i>Corynebacterium insidiosum</i>)	Application	R	2	48.4	~225	1.95	0.45 % Resistant Plants 16.5	University of Minnesota 1991 Rosemount, MN Field
	Vernal (R)			42.0	"	2.22		
	Narragansett (S)			0.8	"	4.00		
	SCORING SYSTEM: Plants scored 0 and 1 (on a 0-5 scale, where 0=no disease and 5=dead plant) considered resistant. Data adjusted to Vernal at 42% resistant plants by the University of Minnesota.							
Common Leafspot (<i>Pseudopeziza medicaginis</i>)	Application							
	MSA-CW3AN3 (R)							
	Ranger (S)							
	SCORING SYSTEM:							

10. A. PEST RESISTANCE (Continued):

DISEASE	VARIETY	SYN. GEN. TESTED	PERCENT RESISTANT PLANTS	NUMBER OF PLANTS TESTED	ASI	ASI LSD .05	INSTITUTION, YEAR, LOCATION, FIELD OR LABORATORY
Downy Mildew (<i>Peronospora trifoliorum</i>)	Application						
Isolate, if known:	Saranac (R)						
	Kanza (S)						
	SCORING SYSTEM:						
Fusarium Wilt (<i>Fusarium oxysporum</i> f. <i>medicaginis</i>)	Application R	2	42.4	~225	3.14	0.66	University of Minnesota 1991 Rosemount, MN Field
	Agate (HR)		54.0	"	2.71	% Resistant Plants 17.8	
	Narragansett (MR)		22.7	"	3.89		
	SCORING SYSTEM: Plants scored 0 and 1 (on a 0-5 scale where 0=no disease and 5=dead plant) considered resistant. Data adjusted to Agate at 54% resistant plants by the University of Minnesota						
Phytophthora Root Rot (<i>Phytophthora megasperma</i> f. <i>medicaginis</i>)	Application						
	Agate (R)						
	Saranac (S)						
	SCORING SYSTEM:						
Verticillium Wilt (<i>Verticillium albo-atrum</i>)	Application S	2	1.0	~300	1.11	0.21	Pioneer Hi-Bred International, Inc. 1991 Arlington, WI Laboratory
	Vertus (R)		40.0	"	2.84	% Resistant Plants 13.5	
	Saranac (S)		3.0	"	1.30		
	SCORING SYSTEM: Plants scored 5-9 (on a 1-9 scale where 9=no disease and 1=dead plant) considered resistant. Data adjusted to Vertus at 40% resistant plants by Pioneer Hi-Bred International, Inc.						
Other (Specify)	Application						
	(R)						
	(S)						
	SCORING SYSTEM:						
Other (Specify)	Application						
	(R)						
	(S)						
	SCORING SYSTEM:						
B. INSECT RESISTANCE:	VARIETY	SYN. GEN. TESTED	PERCENT DEFOLIATION	DEFOLIATION IN PERCENT OF RESISTANT CHECK	ASI	ASI LSD .05	INSTITUTION, YEAR, LOCATION, FIELD OR LABORATORY
INSECT							
Alfalfa Weevil (<i>Hypera postica</i>)	Application						
	Arc (R)			100			
	Saranac (S)						
	SCORING SYSTEM:						

10. B. INSECT RESISTANCE (Continued):

INSECT	VARIETY	SYN. GEN. TESTED	PERCENT SEEDLING SURVIVAL	NUMBER OF SEEDLINGS TESTED	ASI	ASI LSD .05	INSTITUTION, YEAR, LOCATION, FIELD OR LABORATORY
Blue Alfalfa Aphid (<i>Acyrtosiphon kondoi</i>)	Application						
	CUF 101 (R)						
	PA-1 (S)						
	SCORING SYSTEM:						
Pea Aphid (<i>Acyrtosiphon pisum</i>)	Application LR	2	9.7	~300		% Resis- Plants 10.2	Pioneer Hi-Bred International, Inc. 1991 Johnston, IA Laboratory
	XXXX Baker (R)		45.0	"			
	XXXX Vernal (S)		4.0	"			
	SCORING SYSTEM: Plants scored 5-9 (on a 1-9 scale where 9=tall, healthy, plant and 1=dead plant) considered resistant. Data adjusted to Baker at 45% resistant plants by Pioneer Hi-Bred International, Inc.						
Spotted Alfalfa Aphid (<i>Therioaphis maculata</i>) Biotype, if known:	Application R	2	36.8	~300	3.45	% Resis- tant Plants 13.4	Pioneer Hi-Bred International, Inc. 1991 Kerman, CA Laboratory
	XXXX Baker (R)		50.0	"	4.25		
	XXXX Arc (S)		1.1	"	1.18		
	SCORING SYSTEM: Plants scored 5-9 (on a 1-9 scale where 9=no disease and 1=dead plant) considered resistant. Data adjusted to Baker at 50% resistant plants by Pioneer Hi-Bred International, Inc.						
INSECT	VARIETY	SYN. GEN. TESTED	PERCENT RESISTANT PLANTS	NUMBER OF PLANTS TESTED	ASI	ASI LSD .05	INSTITUTION, YEAR, LOCATION, FIELD OR LABORATORY
Potato Leafhopper Yellowing (<i>Empoasca fabae</i>)	Application						
	MSA-CW3An3 (R)						
	Ranger (S)						
	SCORING SYSTEM:						
Other (Specify)	Application						
	(R)						
	(S)						
	SCORING SYSTEM:						
C. NEMATODE RESISTANCE:							
NEMATODE	VARIETY	SYN. GEN. TESTED	PERCENT RESISTANT PLANTS	NUMBER OF PLANTS TESTED	ASI	ASI LSD .05	INSTITUTION, YEAR, LOCATION, FIELD OR LABORATORY
Northern Root Knot (<i>Meloidogyne hapla</i>)	Application						
	Nev. Syn. XX (R)						
	Lahontan (S)						
	SCORING SYSTEM:						

10. C. NEMATODE RESISTANCE (Continued):

9200219

NEMATODE	VARIETY	SYN. GEN. TESTED	PERCENT RESISTANT PLANTS	NUMBER OF PLANTS TESTED	ASI	ASI LSD .05	INSTITUTION, YEAR, LOCATION, FIELD OR LABORATORY
Southern Root Knot (<i>Meloidogyne incognita</i>)	Application						
	Moapa 69 (R)						
	Lahontan (S)						
	SCORING SYSTEM:						
Stem Nematode (<i>Ditylenchus dipsaci</i>)	Application MR	2	19.8	~300		% Resistant Plants	Pioneer Hi-Bred International, Inc. 1991
	Lahontan (R)		50.0	"			
	Ranger (S)		9.1	"		3.7	Connell, WA Laboratory
	SCORING SYSTEM: Plants scored 5-9 (on a 1-9 scale where 9=no symptoms and 1=dead plant) considered resistant. Data adjusted to Lahontan at 50% resistant plants by Pioneer Hi-Bred International, Inc.						
Other (Specify)	Application						
	(R)						
	(S)						
	SCORING SYSTEM:						

11. INDICATE THE VARIETY THAT MOST CLOSELY RESEMBLES THE APPLICATION VARIETY FOR EACH OF THE FOLLOWING CHARACTERS:

CHARACTER	VARIETY	CHARACTER	VARIETY
Winterhardiness	Norseman	Plant Color	-
Recovery After 1st Cut	Norseman	Crown Type	Spreador 2
Area of Adaptation	Spreador 2	Combined Disease Resistance	Spreador 2
Flowering Date	-	Combined Insect Resistance	Lahontan

REFERENCES

Barnes, D.K. 1972. A System for Visually Classifying Alfalfa Flower Color. U.S. Dep. Agric. Handb. 424. 18 pp. (Note: Greenish cast of plate 6, A and B is an artifact of printing, actual colors a blend of yellow and white.)

Elgin, J.H., Jr., (ed.). 1982. Standard Tests to Characterize Pest Resistance in Alfalfa Cultivars. U.S. Dep. Agric. Tech. Bull. (In Press).

Gunn, C.R., W.H. Skrdla, and H.C. Spencer. 1978. Classification of *Medicago sativa* L. using legume characters and flower colors. U.S. Dep. Agric. Tech. Bull. 1574. 84 pp.

Munsell Color Co. 1977. Munsell Plant Tissue Color Charts. Munsell Color Co., Inc. Baltimore.

NOTE: Any additional descriptive information and supporting documentation may be provided as Exhibit D.

'5151'

APPLICATION FOR REVIEW OF ALFALFA VARIETIES FOR CERTIFICATION
National Alfalfa Variety Review Board

(The criteria for evaluation of applications were developed by the Joint Alfalfa Work Conference and the Association of Official Seed Certifying Agencies.)

Applicant's Name Pioneer Hi-Bred International, Inc. Date 11-16-91
 Address P.O. Box 287, Johnston, Iowa 50131
 Sponsoring Institution (if other than applicant) _____
 Breeder's Name (if other than applicant) _____
 Variety Name _____ Experimental Designation(s) XAE05, YAE05, I88PF12

Applicant's signature _____

The breeder or sponsoring institution or organization must describe and DOCUMENT in this application those characteristics of the variety which give it distinctiveness and merit by supplying the information requested below. Information must be supplied for each category excepting those listed as optional. Action will be deferred unless the application is sufficiently documented.

At the time a variety is accepted for certification, a seed sample of the generation or generations requested by the certifying agency shall be submitted to the certifying agency by the sponsor. This lot(s) is to be retained as a control sample against which all future seed stocks released for certified seed production may be compared to establish continued trueness of variety.

- I. A. Estimate the % of the germplasm sources listed below that contribute to the major genetic constitution of this variety.

<u>M.falcata</u>	<u>Ladak</u>	<u>M.varia</u>	<u>Turkistan</u>	<u>Flemish</u>	<u>Chilean</u>
<u>40</u>	<u>5</u>	<u>13</u>	<u>1</u>	<u> </u>	<u>4</u>
<u>Peruvian</u>	<u>Indian</u>	<u>African</u>	<u>Arabian</u>	<u>Unknown</u>	
<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u>37</u>	

- B. A statement of origin (including variety names, germplasm releases and/or PI numbers, and the number of plants or % contribution from each) and the breeding procedures or methods and selection criteria used in developing the variety. Include the procedure for producing breeder seed, the generation (e.g. Syn 1, Syn 2, etc.) that is considered breeder seed, and the year of breeder seed production.

XAE05 is a synthetic variety comprised of 1,000 plants originating from experimental lines tracing to Vernal (24%), N.S. 47 (14%), A224 (7%), A604 (7%), C-6 (7%), N.S. 31 (3%), ScMa 601 (2%), Culver (2%), and other Pioneer germplasm (34%) which trace mainly to creeping rooted selections from Canada.

Parent plants were randomly selected from 86GJH09 whose parents were selected through phenotypic recurrent selection from various experimental lines for one or more of the following: spreading growth habit, above average top growth, field appearance, and resistance to spotted alfalfa aphid and bacterial wilt. Syn 2 seed harvested from parental plants in 1988 in field isolation was considered breeder seed.

C. Seed class to be used, limitations on age of stand and areas of production for each class.

Seed Class	Synthetic Generation	Length of Stand Allowed	Limitation on Acres for Seed Production
Breeder	2	One	None
Foundation	3 or 4	Three	None
Certified	3, 4 or 5	Five	None

Only the synthetic generations given for the above seed classes are recognized as representing this variety. (No supporting data should be used in this application from Syn generations other than those for the Breeder, Foundation and Certified Classes listed here).

D. Procedures for maintaining seed stock:

Breeder seed (Syn 2) produced on 1,000 plants in field isolation in 1988 was bulked. Seed classes will be breeder, foundation and certified. Foundation seed may be produced from breeder or foundation. The second generation foundation seed may be produced at the discretion of Pioneer Hi-Bred International, Inc. Both breeder and foundation seed will be maintained by Pioneer Hi-Bred International, Inc. Certified seed may be produced from breeder or foundation.

E. Any other requirements or limitations necessary to maintain varietal characteristics? None

II. A. Describe the primary use of this variety (if for uses other than hay, haylage, greenchop or dehydration):

B. List states and areas within states where tested for forage and/or persistence. (Present data from each location in III.A. and III.B.).

U.S.A.: Johnston, Iowa; Toledo, Iowa; Owatonna, Minnesota. Canada: Lethbridge, Alberta; Brandon, Manitoba; Arborg, Manitoba; Creston, British Columbia; Swift Current, Saskatchewan; Chatham, Ontario, Canada.

C. List:

1. Areas of adaptation. South central and south western Canada; north central U.S.A.
2. Areas of intended use. South central and south western Canada; north central U.S.A.

III. Evidence of agronomic performance, including data on yield (in T/A) and persistence. Data may be from tests conducted by private firms, Agricultural Experiment Stations or USDA.

- A. Minimum required forage yield data is six location years with at least two locations (two locations must be at least 100 miles apart). Seeding year forage yield data cannot be used to satisfy this requirement. One location must have at least two harvest years beyond seeding year. Each harvest year should be listed separately.

Note: For non-dormant varieties (dormancy level of Moapa 69 or CUF 101) seeding year data may be accepted for up to two of the six location years when four or more cuttings are made in the seeding year.

Summarize Forage Yield Data below:

Test Location	Date Plntd Mo/Yr	Syn Gen	Year Hvst	No. Cuts	This Variety	Total Yield (DM T/A)			LSD .05	CV%
						2. *	3. **	4. _____		
JOHNSTON IA	4/89	2	90	3	5.3	5.9	5.4		0.43	4.3
			91	4	5.8	5.5	5.7		0.48	4.4
JOHNSTON IA	4/90	2	91	4	4.5	4.6	3.9		0.63	7.0
OWATONNA MN	5/89	2	90	3	4.6	4.5	4.9		0.52	6.3
			91	3	4.4	4.8	4.3		0.59	6.7
OWATONNA MN	5/90	2	91	3	4.1	4.7	4.2		0.54	6.3
TOLEDO IA	4/89	2	90	4	6.7	6.7	5.6		0.78	6.2
TOLEDO IA	4/90	2	91	4	4.6	5.5	4.4		0.80	8.1

* VERNAL

** SPREDOR II

Mean Annual Yield

Ck 2 comparison	<u>8</u>	<u>28</u>	<u>5.0</u>	<u>5.3</u>
Ck 3 comparison	<u>8</u>	<u>28</u>	<u>5.0</u>	<u>4.8</u>

Test Location	Date Plntd Mo/Yr	Syn Gen	Year Hvst	No. Cuts	This Variety	Total Yield (DM T/A)			LSD .05	CV%
						2. *	3. **	4. ***		
LETHBRIDGE ALBERTA (DRYLAND)	5/89	2	1990	2	4.87	4.40	3.51	4.11	1.09	19.0
LETHBRIDGE ALBERTA (IRRIGATED)	5/89	2	1990	2	4.91	4.89	4.08	4.83	0.62	9.0
BRANDON MANITOBA (CLAY LOAM)	5/89	2	1990	3	4.43	3.94	3.94	3.74	N.S.	7.0
BRANDON MANITOBA (SANDY LOAM)	5/89	2	1990	3	5.72	4.84	5.15	4.35	N.S.	8.2
ARBORG MANITOBA	5/89	2	1990	2	2.67	2.70	2.69	2.35	0.32	8.6
CRESTON B. C.	5/89	2	1990	3	8.81	9.12	9.50	8.18	0.85	6.0
SWIFT CURRENT SASKATCHEWAN	5/89	2	1990	2	0.97	1.03	1.10	1.07	N.S.	32.3
CHATHAM ONTARIO	5/90	2	1991	3	4.81	4.75	-	-	0.83	9.6

* BEAVER
 ** VERNAL
 *** RAMBLER

Mean Annual Yield

Ck 2 comparison	<u>8</u>	<u>20</u>	<u>4.6</u>	<u>4.4</u>
Ck 3 comparison	<u>7</u>	<u>17</u>	<u>4.6</u>	<u>4.3</u>
Ck 4 comparison	<u>7</u>	<u>17</u>	<u>4.6</u>	<u>4.1</u>

- B. Persistence (winter and drought tolerance, summer survival relative to check varieties). Enter dates of both Initial and Final stand estimates. Data must come from the area of adaptation and from stands at least two years old. More than one location must be given either when persistence is a trait used to justify release or when large diverse geographic areas of adaption are recommended.

Test Loc.	Syn Gen	Date Seeded (Yr/Mo)	Yrs. Hvtd	No. Hvts	Date of Readings Init/Final (Yr/Mo)	This Variety In/Fnl	%Stand Check Varieties		LSD .05	CV%
							*	**		
							In/Fnl	In/Fnl		
1.	2	89/4	3	9	89/7 91/10	98.2 90.3	98.6 91.2	99.1 86.1	1.95 4.24	1.7 3.9
2.	2	89/5	3	8	89/7 91/10	99.5 85.2	98.2 84.3	100.0 81.5	1.85 8.78	1.6 9.0

1. JOHNSTON, IA

* VERNAL

2. OWATONNA, MN

** SPREDOR II

Scoring System used: Data taken as missing six inch units within each plot with total plot size = 72 units.

- C. Fall dormancy as determined from spaced plantings relative to recognized varieties; check varieties must be chosen so as to bracket the dormancy data of this variety.

1. Test data

Test Location	Syn Gen	Date Last Cut (Yr/Mo)	Date Measured (Yr/Mo)	Score or average height This Variety	Check Varieties			LSD .05	CV%
					1.	2.	3.		
Arlington, WI and Johnston, IA	2	91/9 91/8	91/10 91/10	10.7	9.4	12.5	16.0	1.6	12.0

1. = Norseman

2. = Vernal

3. = Arrow

Scoring system used: Average height in cm of space plants; combined analysis using two locations; 10 replications with approximately 25 plants/replication.

2. Indicate which of the following check varieties this variety most nearly compares to in fall dormancy.

<u>VERY DORMANT</u>	<u>DORMANT</u>	<u>MODERATELY DORMANT</u>	<u>NON-DORMANT</u>	<u>VERY NON-DORMANT</u>
Norseman (x)	Vernal () Ranger ()	Saranac () DuPuits () Lahontan ()	Mesilla () Moapa 69 ()	CUF 101 ()

IV. Other descriptive characteristics

- A. Flower color at full bloom. Syn generation observed
2 (see USDA Agriculture Handbook No. 424 - A System
 for Visually Classifying Alfalfa Flower Color).

<u>59</u> % purple	<u>t</u> % cream	<u>1</u> % yellow
<u>40</u> % variegated	<u>t</u> % white	

- B. (Document other distinctive characteristics such as pod, leaf or root traits, biochemical markers, etc.)

V. Pest Resistance Characteristics

PLEASE FOLLOW THESE INSTRUCTIONS CAREFULLY WHEN REPORTING PEST RESISTANCE RESULTS.

Furnish comparative data on the following insects and diseases (and others where applicable) for your variety. Data may be from tests conducted by private firms, Agricultural Experiment Stations, or USDA. Tests should be conducted by standard procedures as described in ARS Misc. publication 1434. Each disease and insect test must include published resistant and susceptible checks. Statistics must include the test mean (mean of all entries in test), LSD (.05), and CV (%) for unadjusted % resistance and ASI data that are reported. Resistance levels should be characterized using % resistant plants as follows: S=<6%, LR=6-14%, MR=15-30%, R=31-50%, HR=>50%. Do not refer to tolerance. Checks should be characterized based on long term % resistance averages published in ARS Misc. publication 1434. If data for the resistant check does not fit its expected resistance class (MR, R, HR, etc.) data must be adjusted to the long term mean for the published resistant check. If data has been adjusted, supply both adjusted and unadjusted values and indicate how and by whom the adjustment was made.

At the time a variety is accepted for certification, a seed sample of the generation or generations requested by the certifying agency shall be submitted to the certifying agency by the sponsor. This lot(s) is to be retained as a control sample against which all future seed stocks released for certified seed production may be compared to establish continued trueness of variety.

If a scoring or rating system is used, specify the limits and meaning of scores. NOTE: If a pest reaction of the variety falls on or just above a resistance category level (+2% for LR, MR, and R; +3% for HR) and the higher rating is claimed, results of a second test must be reported. If the two tests do not agree, the lower rating is appropriate unless further testing supports the higher rating. Pest resistance data must be submitted on at least six of the following nine pests: anthracnose, bacterial wilt, Fusarium wilt, Verticillium wilt, Phytophthora root rot, stem nematode, pea aphid, spotted alfalfa aphid, and blue alfalfa aphid. For the pests where no data is available enter "Not tested". The six required pests must be selected from those that frequently cause significant losses on susceptible cultivars in the area of intended use of this variety. Show generation of seed used for each test.

ANTHRACNOSE (Race 1)Test conducted by Pioneer Hi-Bred International, Inc. at Johnston, IA

Variety	Resistance Class	Year Tested	Syn Gen	Unadjusted % R	Adjusted % R	Score or A.S.I.
Test Variety	S	1989	2	0.0	0.0	
1. ARC	HR			45.9	65.0	
2. SARANAC	S			0.0	0.0	
3.						
Test Mean:				30.8	42.7	
L.S.D. (.05)				13.0	18.4	
C.V. (%)				19.0	19.0	

Scoring system used: % surviving seedlings. Data adjusted to ARC at 65% resistant plants by Pioneer Hi-Bred International, Inc.

BACTERIAL WILTTest conducted by University of Minnesota at Rosemount, MN

Variety	Resistance Class	Year Tested	Syn Gen	Unadjusted % R	Adjusted % R	Score or A.S.I.
Test Variety	R	1991	2	42.0	48.4	1.95
1. VERNAL	R			36.5	42.0	2.22
2. NARRAGANSETT	S			0.7	0.8	4.00
3.						
Test Mean:				47.3	54.5	1.88
L.S.D. (.05)				14.4	16.5	0.45
C.V. (%)				18.8	18.8	14.80

Scoring system used: Plants scored 0 and 1 (on a 0-5 scale, where 0 = no disease, and 5 = dead plant) considered resistant. Data adjusted to Vernal at 42% resistant plants by the University of Minnesota.

FUSARIUM WILT

Test conducted by the University of Minnesota at Rosemount, MN

Variety	Resistance Class	Year Tested	Syn Gen	Unadjusted % R	Adjusted % R	Score or A.S.I.
Test Variety	R	1991	2	37.7	42.4	3.14
1. AGATE	HR			48.0	54.0	2.71
2. NARRAGANSETT	MR			20.2	22.7	3.89
3. MNGN-1	S			4.6	5.1	4.69
Test Mean:				53.4	60.0	2.49
L.S.D. (.05)				15.9	17.8	0.66
C.V. (%)				18.5	18.5	16.60

Scoring system used: Plants scored 0 and 1 (on a 0-5 scale, where 0 = no disease, and 5 = dead plant) considered resistant. Data adjusted to Agate at 54% resistant plants by the University of Minnesota.

VERTICILLIUM WILT

Test conducted by Pioneer Hi-Bred International, Inc. at Arlington, WI

Variety	Resistance Class	Year Tested	Syn Gen	Unadjusted % R	Adjusted % R	Score or A.S.I.
Test Variety	S	1991	2	1	1	1.11
1. VERTUS	R			30	40	2.84
2. SARANAC	S			2	3	1.30
3.						
Test Mean:				19.7	26.3	2.30
L.S.D. (.05)				10.1	13.5	0.21
C.V. (%)				42.0	42.0	23.00

Scoring system used: Plants scored 5-9 (on a 1-9 scale, where 9 = no disease, and 1 = dead plant) considered resistant. Data adjusted to Vertus at 40% resistant plants by Pioneer Hi-Bred International, Inc.

PHYTOPHTHORA ROOT ROT

Test conducted by _____ at _____

Variety	Resistance Class	Year Tested	Syn Gen	Unadjusted % R	Adjusted % R	Score or A.S.I.
---------	------------------	-------------	---------	----------------	--------------	-----------------

Test Variety

1.						
2.						
3.						

NOT TESTED

Test Mean:
L.S.D. (.05)
C.V. (%)

Scoring system used:

STEM NEMATODE

Test conducted by Pioneer Hi-Bred International, Inc. at Connell, WA

Variety	Resistance Class	Year Tested	Syn Gen	Unadjusted % R	Adjusted % R	Score or A.S.I.
---------	------------------	-------------	---------	----------------	--------------	-----------------

Test Variety	MR	1991	2	21.2	19.8	
1. LAHONTAN	R			53.6	50.0	
2. RANGER	S			9.8	9.1	
3.						

Test Mean:				35.1	32.8	
L.S.D. (.05)				4.0	3.7	
C.V. (%)				7.0	7.0	

Scoring system used: Plants scored 5-9 (on a 1-9 scale, where 9 = no symptoms, and 1 = dead plant) considered resistant. Data adjusted to Lahontan at 50% resistant plants by Pioneer Hi-Bred International, Inc.

PEA APHID

Test conducted by Pioneer Hi-Bred International, Inc. at Johnston, IA

Variety	Resistance Class	Year Tested	Syn Gen	Unadjusted % R	Adjusted % R	Score or A.S.I.
Test Variety	LR	1991	2	9.8	9.7	
1. BAKER	R			45.4	45.0	
2. VERNAL	S			4.0	4.0	
3.						
Test Mean:				36.3	36.0	
L.S.D. (.05)				10.3	10.2	
C.V. (%)				18.0	18.0	

Scoring system used: Plants scored 5-9 (on a 1-9 scale, where 9 = tall healthy plant, and 1 = dead plant) considered resistant. Data adjusted to Baker at 45% resistant plants by Pioneer Hi-Bred International, Inc.

SPOTTED ALFALFA APHID

Test conducted by Pioneer Hi-Bred International, Inc. at Kerman, CA

Variety	Resistance Class	Year Tested	Syn Gen	Unadjusted % R	Adjusted % R	Score or A.S.I.
Test Variety	R	1991	2	40.1	36.8	3.45
1. BAKER	R			54.6	50.0	4.25
2. ARC	S			1.2	1.1	1.18
3.						
Test Mean:				46.2	42.3	4.00
L.S.D. (.05)				14.6	13.4	0.99
C.V. (%)				20.0	20.0	16.00

Scoring system used: Plants scored 5-9 (on a 1-9 scale, where 9 = no disease and 1 = dead plant) considered resistant. Data adjusted to Baker at 50% resistant plants by Pioneer Hi-Bred International, Inc.

BLUE ALFALFA APHID

Test conducted by _____ at _____

Variety	Resistance Class	Year Tested	Syn Gen	Unadjusted % R	Adjusted % R	Score or A.S.I.
---------	---------------------	----------------	------------	-------------------	-----------------	--------------------

Test Variety1.
2.
3.

NOT TESTED

Test Mean:
L.S.D. (.05)
C.V. (%)

Scoring system used:

Please attach a one page description/summary of your variety as you wish it published by AOSCA. This description must stand on its own; please use complete sentences and number each item following the format given below.

Include the following:

1. A statement of genetic origin (including variety names, germplasm releases, and/or PI numbers that contributed to the major genetic constitution of this variety) and the breeding procedures, methods, and selection criteria used in developing the variety. Estimate the % of the major germplasm sources contributing to this cultivar. (see I.A.)
2. Area of probable adaptation and use (geographic area) and primary purpose (hay, grazing, etc.) for which this variety will be used. Report states where the variety has been tested for yield and persistence and proposed areas of intended use.
3. Descriptive characteristics such as fall dormancy, flower color, and any other morphological or physiological characteristics that may be used as identifying traits.
4. A statement relative to the varieties resistance to anthracnose, bacterial wilt, Fusarium wilt, Verticillium wilt, Phytophthora root rot, stem nematode, pea aphid, spotted alfalfa aphid, and blue alfalfa aphid and other evaluated pests.
5. Procedures for maintaining seed stock, seed classes to be used, a statement as to the limitation of age of stand and generations that may be certified and other requirements or limitations necessary to maintain varietal characteristics.
6. If this variety is accepted by official certifying agencies, when will certified seed first be offered for sale?
7. Will application be made for protection under the Plant Variety Protection Act and if so, will the certification option be requested?
8. As a means of added varietal protection, are you willing to have the information in this application turned over to the PVP office?

XAE05

1. XAE05 is a synthetic variety comprised of 1,000 plants originating from experimental lines tracing to Vernal, N.S. 47, A224, A604, C-6, N.S. 31, ScMa 601, Culver, and other germplasm of unknown origin. Parent plants were randomly selected from an experimental whose parents were selected through phenotypic recurrent selection from various experimental lines for one or more of the following: spreading growth habit, above average top growth, field appearance and resistance to spotted alfalfa aphid and bacterial wilt. Germplasm sources are: M. falcata (40%), Ladak (5%), M. varia (13%), Turkistan (1%), Chilean (4%) and unknown (37%).
2. XAE05 is adapted to and intended for use in the north central region of the United States and south central and south western regions of Canada for hay, haylage, greenchop and dehydration. XAE05 has been tested in Iowa; Minnesota; Alberta, Canada; British Columbia, Canada; Manitoba, Canada; Saskatchewan, Canada; Ontario, Canada.
3. XAE05 is a dormant cultivar with fall dormancy similar to Norseman. Flower color of the Syn 2 generation is approximately 59% purple, 40% variegated, 1% yellow, and a trace of white and cream. Growth habit is erect in midsummer and prostrate in the fall.
4. XAE05 has resistance to bacterial wilt, Fusarium wilt, and spotted alfalfa aphid; moderate resistance to stem nematode and low resistance to pea aphid. XAE05 is susceptible to Anthracnose (race 1) and Verticillium wilt, and has not been tested for Phytophthora root rot or blue aphid.
5. Breeder seed (Syn 2) was produced on parent plants in field isolation and bulked. Seed classes will be breeder, foundation (Syn 3 or Syn 4) and certified (Syn 3, Syn 4, or Syn 5). Foundation seed may be produced from breeder or foundation. The second generation foundation may be produced at the discretion of Pioneer Hi-Bred International, Inc. Limitation on ages of stand will be three and five years, respectively for foundation and certified seed. Sufficient breeder and foundation seed for the projected life of the variety will be maintained by Pioneer Hi-Bred International, Inc.
6. Seed will be marketed in the spring of 1993.
7. Application for Plant Variety Protection will be made and the certification option will not be requested.
8. As a means of added varietal protection, information included with the Application for Review of Alfalfa Variety for Certification may be provided to the PVP office.

EXHIBIT E

STATEMENT OF THE BASIS OF APPLICANT'S OWNERSHIP

'5151'

Pioneer Hi-Bred International, Inc., Des Moines, Iowa, is the employer of the plant breeders involved in the development and evaluation of 5151. Pioneer Hi-Bred International, Inc. has the sole rights and ownership of 5151.